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Effect of nitrogen and potassium on growth, flower yield and quality of golden rod

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Abstract : An experiment entitled, effect of nitrogen and potassium on growth, flower yield and quality of golden rod was carried out at Horticulture Section, College of Agriculture, Nagpur, during Nov., 2009 to April, 2010 with sixteen treatment combinations in factorial randomized block design. The treatments comprised of four levels (0, 50, 100 and 150 kg ha^{-1}) each of nitrogen and potassium. The results revealed that, an application of 150 kg ha^{-1} each of nitrogen and potassium produced maximum length of flower stalk of golden rod, number of inflorescence flower $stalk^{-1}$ and maximum durability of inflorescence *in situ*. Whereas, maximum spread of inflorescence, vase life of flower stalk and yield of flower stalks ha^{-1} were recorded under the treatment 150 kg N ha^{-1} and 100 kg K_2O ha^{-1}. However, the maximum length of inflorescence was recorded due to the application of 100 kg each of nitrogen and potassium ha^{-1}.

Key words : Golden rod, Nitrogen, Potassium, Flower yield, Quality

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Golden rod (*Solidago canadensis* L.) is a perennial flowering plant which is grown for its attractive, long and straight flower stalk. It is commonly used for cut flower in India. Because of its easy cultivation, adaptability to varying soil and climatic conditions and excellent keeping quality, there is a great scope for cultivation of golden rod in India. It is well known that, nutrition plays an important role in improvement of growth and yield in flower crops like golden rod. Potassium also plays an important role in golden rod cultivation. However, the response of potassium increases significantly in the presence of nitrogen.

RESEARCH METHODS

The present investigation was carried out at Horticulture Section, College of Agriculture, Nagpur during Nov., 2009 to April, 2010 to study the effect of nitrogen and potassium on growth and flowering of golden rod. Sixteen treatment combinations with four levels of nitrogen (0, 50, 100 and 150 kg ha^{-1}) and four levels of potassium (0, 50, 100 and 150 kg ha^{-1}) were tried in factorial randomized block design with three replications. Golden rod suckers of uniform size were transplanted at the spacing of 30 cm x 30 cm in the month of November, 2009. Half the dose of nitrogen and full dose of potassium were applied as per the treatment before transplanting and the remaining half dose of nitrogen was applied after 45 days of transplanting. However, phosphorus was applied as a basal dose before transplanting. Various growth, flowering and yield observations *viz.,* height of plant (cm) at 90 days after transplanting, length of flower stalk and inflorescence (cm), inflorescence flower $stalk^{-1}$, spread of inflorescence (cm), durability of inflorescence *in situ* (days), vase life of flower stalk (days) and flower stalks $plant^{-1}$ and ha^{-1} (lakh) were recorded.

RESEARCH FINDINGS AND DISCUSSION

The data presented in Table 1 revealed that, different levels of nitrogen and potassium had significant effect on all growth and flowering parameters of golden rod studied.

Growth:

Significantly the highest plant height (21.13 cm) was recorded at higher level of nitrogen *i.e.* 150 kg N ha^{-1} which was followed by the treatment of 100 kg N ha^{-1} (19.64 cm), whereas, application of 0 kg N ha^{-1} had produced significantly minimum plant height (17.31 cm).

Table 1 : Effect of nitrogen and potassium on growth, flower yield and quality of golden rod

Treatments	Plant height (cm)	Length of flower stalk (cm)	Length of inflorescence (cm)	Number of inflorescence flower stalk^{-1}	Spread of inflorescence (cm)	Durability of inflorescence *in situ* (days)	No. of flower stalks plant^{-1}	No. of flower stalks ha^{-1} (lakh)
Nitrogen (N)								
N_0 - 0 kg N ha^{-1}	17.31	53.02	7.19	25.97	17.10	8.58	2.36	2.26
N_1 - 50 kg N ha^{-1}	17.56	59.13	8.47	34.88	18.25	9.57	2.82	2.74
N_2 - 100 kg N ha^{-1}	19.64	66.03	8.98	42.21	19.25	11.09	3.34	2.90
N_3-150 kg N ha^{-1}	21.13	68.19	8.62	42.50	20.63	12.58	3.67	3.69
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.14	0.77	0.05	0.36	0.08	0.16	0.11	0.09
C.D. (P= 0.05)	0.42	2.24	0.16	1.06	0.24	0.47	0.33	0.25
Potassium (K)								
K_0 - 0 kg N ha^{-1}	18.66	59.25	8.02	35.04	18.45	9.80	3.08	2.84
K_1 -50 kg N ha^{-1}	18.79	60.51	8.26	36.19	18.54	10.65	3.00	2.92
K_2 - 100 kg N ha^{-1}	18.95	62.69	8.58	37.04	19.33	10.67	3.29	3.10
K_3- 150 kg N ha^{-1}	19.22	63.90	8.37	37.27	19.10	10.70	2.76	2.72
F test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) ±	0.14	0.77	0.05	0.36	0.08	0.16	0.11	0.09
C.D. (P= 0.05)	0.42	2.24	0.16	0.06	0.24	0.47	0.33	0.25
Interaction N x K								
F test	NS	NS	NS	NS	NS	NS	NS	NS
SE (m) ±	0.29	1.55	0.11	0.73	0.16	0.33	0.22	0.17
C.D. (P= 0.05)	-	-	-	-	-	-	-	-

Sig. = Significant NS=Non-significant

This might be due to general improvement of growth and development of plant by nitrogenous fertilizers as nitrogen is involved in various metabolic processes of plant. Similar increase in height of plant due to higher dose of nitrogen was recorded by Baboo *et al*. (2005) in African marigold and Sharma and Singh (2007) in gladiolus.

Similarly, the treatment of 150 kg K_2O ha^{-1} had produced significantly the maximum height of plant (19.22 cm) and it was found to be at par with the treatment of 100 kg K_2O ha^{-1} (18.95 cm), however, significantly minimum plant height (18.66 cm) was produced due to non-application of potassium which was found at par with 50 kg K_2O ha^{-1}(18.79 cm). The beneficial effect of potassium in promoting the growth of golden rod plants

Table 2: Effect of nitrogen and potassium on vase life of flower stalk of golden rod

Treatments	Vase life of flower stalk (days)				
	Potassium levels				
	K_0 - 0 kg K_2O ha^{-1}	K_1- 50 kg K_2O ha^{-1}	K_2 - 100 kg K_2O ha^{-1}	K_3 -150 kg K_2O ha^{-1}	Mean
Nitrogen levels					
N_0-0 kg N ha^{-1}	5.10	5.30	5.40	5.20	5.25
N_1-50 kg N ha^{-1}	5.60	5.80	5.73	6.20	5.83
N_2-100 kg N ha^{-1}	6.43	7.33	7.83	7.27	7.23
N_3-150 kg N ha^{-1}	8.00	8.33	8.40	8.30	8.26
Mean	6.28	6.69	6.84	6.74	
	Factor A (N)		Factor B (K)		Interaction (N x K)
F test	Sig.		Sig.		N. S.
S.E. (m) ±	0.04		0.04		0.09
C.D. (P=0.05)	0.14		0.14		0.29

Sig.=Significant, NS=Nono-significant

may be explained from the fact that, potassium involved in synthesis of peptide bond and protein and carbohydrate metabolism and also participates in rapid cell division and differentiation. Similar increase in growth of African marigold due to application of higher dose of potassium was reported by Pal and Ghosh (2010).

The interaction effect due to nitrogen and potassium on height of golden rod plant was found to be non significant.

Flowering and yield:

Significantly the maximum length of flower stalk (68.19 cm), inflorescence flower stalk^{-1} (42.50), spread of inflorescence (20.63 cm), durability of inflorescence *in situ* (12.58 days) and yield of flower stalks plant^{-1} (3.67) and ha^{-1} (3.69 lakh) were recorded under the treatment 150 kg N ha^{-1} and it was found to be at par with the treatment of 100 kg N ha^{-1} in respect of length of flower stalk (66.03 cm), inflorescence flower stalk^{-1} (42.21) and flower stalks plant^{-1} (3.34). However, the maximum length of inflorescence was noted due to application of 100 kg N ha^{-1} (8.98 cm), which was followed by the treatment of 150 kg N ha^{-1} (8.62 cm). The improvement in quality and yield of flower stalk under the highest and moderate level of nitrogen might be due to improved vegetative growth of plant. The similar results were obtained by Jain and Gupta (2004) in African marigold and Grawal *et al.* (2004) in chrysanthemum.

The treatment of 100 kg K_2O ha^{-1} was found significantly superior in respect of length of inflorescence (8.58 cm), spread of inflorescence (19.33 cm) and yield of flower stalks plant^{-1} (3.29) and ha^{-1} (3.10 lakh), however, significantly the maximum length of flower stalk (63.90 cm), inflorescence flower stalk^{-1} (37.27) and durability of inflorescence in situ (10.70 days) were noticed due to application of 150 kg K_2O ha^{-1} which was found to be at par with 100 kg K_2O ha^{-1} in respect of length of flower stalk and durability of inflorescence *in situ* (62.69 cm and 10.67 days, respectively). Whereas, significantly minimum length of flower stalk (59.25 cm), length of inflorescence (8.02 cm), inflorescence flower stalk^{-1} (35.04), spread of inflorescence (18.45 cm), durability of inflorescence *in situ* (9.80 days) and the yield of flower stalks ha^{-1} (2.84 lakh) were noted under the treatment of 0 kg K_2O ha^{-1}.This might be due to the role of adequate level of potassium in promotion of plant growth, flower yield and also improvement in quality of flowers. The similar results were obtained by Hunmilli and Paswan (2003) in gerbera.

The data pertaining to the flower yield and quality parameters studied in golden rod were not influenced statistically due to an interaction of nitrogen and potassium levels.

Vase life of flower :

The data from Table 2 indicated that, significantly maximum vase life of flower stalk of golden rod was noticed with the treatment of 150 kg N ha^{-1} (8.26 days) which was followed by 100 kg N ha^{-1} (7.23 days), however, significantly minimum vase life of flower was recorded with application of 0 kg N ha^{-1} (5.25 days).

Similarly, the vase life of flower stalk was found to be maximum with the treatment of 100 kg K_2O ha^{-1} (6.84 days) which was found at par with 150 kg K_2O ha^{-1}(6.74 days), whereas, significantly minimum vase life of flower was noted with no application of potassium (6.28 days).

An interaction effect of nitrogen and potassium on vase life of flower stalk of golden rod was found to be significant. Significantly the maximum vase life of golden rod flower was exhibited under the treatment combination N_3K_2 *i.e.* 150 kg N ha^{-1} with 100 kg K_2O ha^{-1}(8.40 days) which was found to be at par with the treatment combination N_3K_1 (8.33 days) and N_3K_3 (8.30 days), whereas, minimum vase life of flower stalk was noted with the treatment combination of N_0K_0 *i.e.* no application of nitrogen and potassium (5.10 days). This might be due to increased length and number of inflorescence produced flower stalk^{-1} of golden rod due to application of 150 kg N and 100 kg K_2O ha^{-1}. Similar results are quoted by Verma *et al*. (2007) in chrysanthemum.

Thus, it can be inferred that, for getting maximum production of better quality flowers of golden rod an application of 150 kg nitrogen and 100 kg potassium hectare^{-1} was found beneficial.

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